

SEX WORK

Anal and dry sex in commercial sex work, and relation to risk for sexually transmitted infections and HIV in Meru, Kenya

M Schwandt, C Morris, A Ferguson, E Ngugi, S Moses



Sex Transm Infect 2006;**82**:392–396. doi: 10.1136/sti.2006.019794

See end of article for authors' affiliations

Correspondence to: Michael Schwandt, University of Manitoba, c/o 543–730 William Avenue, Winnipeg, Manitoba, Canada, R3E 0W3; michael_schwandt@umanitoba.ca

Accepted for publication 5 June 2006
Published Online First 21 June 2006

Objective: To examine the practices of anal intercourse and dry sex within a cohort of female sex workers (FSWs) in Kenya, focusing on the prevalence and perceived risk of the practices, demographic and behavioural correlates, and association with sexually transmitted infections (STI).

Methods: A survey was conducted among FSWs in Meru, Kenya, with 147 participants randomly sampled from an existing cohort of self identified FSWs.

Results: 40.8% of participants reported ever practising anal intercourse and 36.1% reported ever practising dry sex. Although the majority of women surveyed believed anal intercourse and dry sex to be high risk practices for HIV infection compared with vaginal sex, about one third of women reported never or rarely using condoms during anal intercourse, and about 20% never or rarely using condoms during dry sex. Reported consistent condom use was lower with both of these practices than with penile-vaginal intercourse. Anal intercourse was associated with experience of recent forced sexual intercourse, while dry sex was not. Anal intercourse was almost always initiated by clients, whereas dry sex was likely to be initiated by the women themselves. Sex workers reported charging higher fees for both practices than for vaginal intercourse. Both practices were associated with reported symptoms and diagnoses of STI.

Conclusions: Both anal intercourse and dry sex were common in this sample, and although perceived as high risk practices, were not adequately protected with condom use. Education and other interventions regarding these high risk sexual behaviours need to be translated into safer practices, particularly consistent condom use, even in the face of financial vulnerability.

Sexual practices in sub-Saharan Africa have often been perceived as limited to penile-vaginal sex. However, recent research has cast doubt on this notion, finding that the prevalence of anal intercourse may be higher than previously thought. In 2003, 20% of a cohort of female sex workers (FSWs) surveyed in Kenya reported having practised anal intercourse.¹ Another study found that 14% of a cohort of sex workers in Kenya reported practising anal intercourse,² and in a cohort of South African sex workers surveyed at truck stops, 42.8% reported having done so.³ A study employing coital diary data gathering techniques among FSWs in KwaZulu-Natal, South Africa, found an average frequency of five acts of anal intercourse per week among FSWs surveyed.⁴ Anal intercourse may also be more common than appreciated among other groups. In a cohort of male and female students in Tanzania, 9% reported anal intercourse as their first sexual experience,⁵ and in a study of female college students in Togo, 12% reported experience of anal intercourse.⁶

Anal intercourse has been shown to be associated with high risk of HIV acquisition among women,^{7,8} and the probability of HIV transmission, per contact, has been estimated to be 10 times higher for penile-anal than penile-vaginal sex.⁹ Among a group of FSWs in Kenya, experience of anal intercourse was associated with experience of sexually transmitted infections (STIs).¹ Within a cohort of FSWs in South Africa, the prevalence of HIV was higher (61.3%) among those reporting anal intercourse than among those not reporting the practice (42.7%). In a multicentre study of sex workers in sub-Saharan Africa, higher rates of self reported anal intercourse by site were associated with increased risk of seroconversion.¹⁰ While anal intercourse has been shown to be a high risk practice with respect to

STI/HIV transmission, it may not be regarded as such among some populations. Among a cohort of FSWs surveyed in Kenya, anal intercourse was perceived as neither higher nor lower in risk than penile-vaginal intercourse.¹ A study of secondary school students in Kwa-Zulu Natal, South Africa, found that 15% of students considered anal intercourse to be a safe alternative to vaginal sex.¹¹ Anal intercourse may also serve as a marker of vulnerability to other risk factors for STI/HIV infection. Among a cohort of FSWs surveyed in Kenya, experience of anal intercourse was associated with non-use of condoms, forced sex, and a higher occurrence of STI.¹

Dry sex refers to the practice of applying astringent agents or actions to the vagina before sexual intercourse. The practice has been described primarily in central and southern Africa, as well as in south east Asia and the Caribbean.¹² Methods documented include the insertion of powders, leaves, or other preparations into the vagina, drying the vagina with cloth or paper, and vaginal douching. The motivation most often cited for the practice is enhanced sexual pleasure for the male partner through increased sensation of dryness or tightness.^{13,14} The practice of dry sex has been shown to be as prevalent as 86% among a cohort of women in Zambia¹⁵ and 93% in a female cohort in Zimbabwe.¹³

Drying practices can produce inflammatory reactions and epithelial damage in the vagina, resulting in ulceration, sloughing of the vaginal wall, and necrosis.^{14,16} It is known that genital lesions caused by STI increase the risk of HIV transmission,¹⁷ and it is possible that lesions arising from dry sex pose a similar risk.¹⁸ The risks associated with dry sex

Abbreviations: FSWs, female sex workers; STI, sexually transmitted infections

have not been widely investigated or clearly elucidated. Among a cohort of 634 women in Zambia, those who developed HIV within 1 year of an initially negative HIV test were more likely to have practised dry sex.¹⁹ A survey of 513 young adults in peri-urban Gauteng Province, South Africa, found an association between the practice of dry sex and STI occurrence among men but not women.¹⁸ Other studies investigating the possible association between dry sex and STI transmission have produced inconclusive results.^{12–20} In a pattern similar to findings regarding anal intercourse in Kenya, dry sex may also be a marker of vulnerability to risk factors for STI/HIV. Among a South African cohort, younger age and lower level of education were predictive of dry sex practice.¹⁸ Furthermore, focus group discussions within a Zimbabwean cohort revealed that the practice of dry sex may be a deterrent for the use of condoms.²¹

This study examines knowledge and practices of these two high risk sexual behaviours among a cohort of female sex workers in Meru, Kenya. It was carried out with a view to informing the development and refinement of educational programmes to help prevent the spread of HIV in this vulnerable population.

METHODS

Eight groups of self identified female sex workers involved in a peer education and outreach programme were identified in the town of Meru, Kenya (population 130 000, located about 175 km north east of the capital city, Nairobi). The membership in the groups totalled 708 women at the time of the study. One third of the members were selected using a systematic random sampling technique, and these 236 women were requested by programme staff to participate in the study; 147 women (62%) agreed to participate. A standardised questionnaire, previously used in western Kenya, was modified to improve elicitation of details regarding attitudes and practices. Reviews of research on sex work have found that the methods employed in eliciting personal information influence the comprehensiveness of responses provided.^{1–4–22} Enhanced clarity and sensitivity in the survey design improves response rates to questions addressing sexual behaviour. Accordingly, the wording of questions referring to sex practices was refined to be as clear and inoffensive as possible to participants.

Ethical approval for the study was obtained from the University of Manitoba health research ethics board (Canada) and the Kenyatta National Hospital ethical review committee (Kenya). The interviews were conducted over a 3 day period in Meru by a team of five experienced female interviewers, under the direction of a field supervisor. Each survey took roughly 1 hour to administer. Individual participants were interviewed in isolation from one another and from the larger community of Meru, so as to ensure confidentiality of the responses and comfort of the respondents. Data entry and analysis were carried out using SPSS for Windows, Version 12.0.

RESULTS

Sociodemographic information and sex work characteristics

The mean age of participants was 35 years, with a range of 15–63. In all, 3.4% of women were married or cohabiting, 9.5% were widowed, 29.3% were divorced or separated, and 57.8% had never been married; 94.6% of participants had one or more biological children, with a mean of 2.9 (median 3). Participants reported completion of a mean of 6 years of formal education; 15.0% of participants were leaders of the peer education groups sampled; 93.9% of participants reported Meru tribal ethnicity (the group indigenous to the site of the survey); 56.5% of women identified as Catholic, 29.3% as Protestant, 8.2% as Muslim, and the remainder reported other religions.

Participants reported a mean of 6.4 total sexual partners within the week preceding the survey (median 5). Of these partners, mean reported weekly client totals were 3.3 one time clients (median 3) and 2.8 regular clients (median 2); 95.9% of participants reported sexual intercourse with one or more clients within the week preceding the survey, while 25.9% of women reported intercourse with a spouse or committed partner during this period. Sixty six per cent of participants reported consistent condom use with one time clients and 55.8% with regular clients; 29.3% of participants reported the experience of forced sexual intercourse within the previous 6 months; 15.6% reported experience of a genital sore, 21.8% reported experience of vaginal discharge, and 34.0% reported physician diagnosis of an STI within the 12 months before the study.

Anal intercourse

Anal intercourse was found to be quite common in this cohort: 40.8% of FSWs surveyed reported having ever practised anal intercourse. 74.2% of FSWs surveyed believed anal intercourse to be of greater or equally high risk for STI/HIV compared with vaginal sex and 23.8% believed the practice to be of lower risk (table 1). Of the women who reported having practised anal intercourse, 50.0% reported a frequency of anal intercourse equal to or greater than once per month (table 2). Only 45.0% reported consistent condom use during anal intercourse, and 26.7% reported never using condoms. Among participants engaging in anal intercourse, 96.6% reported that the practice was predominantly initiated by their clients, with 1.7% reporting anal intercourse to be initiated by themselves and 1.7% reporting the practice to be initiated by both clients and themselves (table 2). Of participants practising anal intercourse, 68.3% reported charging a greater fee compared to vaginal intercourse. Of participants practising anal intercourse, only 5.0% reported doing so with spouses or committed partners, while 43.3% reported practising anal intercourse with regular paying clients and 78.3% with one time paying clients (table 3).

There was no significant association between perceived risk of anal intercourse and abstinence from anal intercourse. Anal intercourse was associated with lower overall frequency of condom use during intercourse with both one time clients ($p<0.05$) and regular clients ($p<0.01$), but not with spouses or committed partners. A significant association was found between the practice of anal intercourse and experience of forced sexual intercourse (of any type) within the previous 6 months ($p<0.001$). Peer education group leaders were less likely to practise anal intercourse than regular group members ($p<0.005$). No association was found between anal intercourse and ethnicity, religion or education, but anal intercourse was associated with older age ($p<0.05$). In addition, women reporting anal intercourse were more likely to report an STI within the previous year ($p<0.005$),

Table 1 Perceived risk for sexually transmitted infections of anal intercourse and dry sex, relative to standard vaginal intercourse (n = 147)

	Anal intercourse	Dry sex
Greater risk	64.0% (94)	73.5% (108)
Less risk	23.8% (35)	14.3% (21)
Equal risk	10.2% (15)	9.5% (14)
Don't know	2.0% (3)	2.7% (4)
Total	100.0% (147)	100.0% (147)

Table 2 Characteristics of anal intercourse and dry sex among women reporting either practice

	Anal intercourse (n = 60)	Dry sex (n = 53)
Frequency of practice		
20–29 times per month	1.7% (1)	20.8% (11)
11–19 times per month	6.7% (4)	11.3% (6)
6–10 times per month	5.0% (3)	18.9% (10)
1–5 times per month	36.6% (22)	24.5% (13)
Less than one time per month	50.0% (30)	22.6% (12)
Don't know	0.0% (0)	1.9% (1)
Total	100.0% (60)	100.0% (53)
Condom use		
Every time	45.0% (27)	47.2% (25)
Usually	23.3% (14)	32.1% (17)
Rarely	5.0% (3)	7.5% (4)
Never	26.7% (16)	13.2% (7)
Total	100.0% (60)	100.0% (53)
Usual initiating partner		
Female sex worker	1.7% (1)	34.0% (18)
Client	96.6% (58)	54.7% (29)
Both	1.7% (1)	11.3% (6)
Total	100.0% (60)	100.0% (53)
Fee charged		
More than standard vaginal	68.3% (41)	66.0% (35)
Less than standard vaginal	10.0% (6)	5.7% (3)
Same as standard vaginal	21.7% (13)	28.3% (15)
Total	100.0% (60)	100.0% (53)

including genital sores ($p < 0.005$) and vaginal discharge ($p < 0.001$).

Dry sex

The practice of dry sex was reported by 36.1% of the women; 83.0% of participants believed dry sex posed a greater or equally high risk for STI/HIV compared to vaginal sex, and 14.3% believed the practice to be of lower risk (table 1). Among women who had engaged in dry sex, 75.5% reported practising dry sex one or more times per month (table 2); 47.2% of women reported consistent use of condoms during dry sex and 13.2% reporting never using condoms during dry sex (table 2). Reported condom use during dry sex was therefore less consistent than during vaginal intercourse, but more consistent than during anal intercourse. Thirty four per cent of participants practising dry sex reported initiating it themselves, with 54.7% reporting initiation by clients. Sixty six per cent of participants practising dry sex reported charging a greater fee for dry sex than for vaginal intercourse (table 2). Of participants practising dry sex, only 13.2% reported the practice with a spouse or committed partner, 60.4% with regular paying clients, and 79.2% with one time paying clients (table 3).

Unlike anal intercourse, there was a significant association between perceived risk of dry sex and abstinence from the practice ($p < 0.05$). Dry sex was associated with lower overall frequency of condom use during intercourse with both one time clients ($p < 0.01$) and regular clients ($p < 0.005$). As opposed to anal intercourse, there was an association

between dry sex and reported greater number of clients per week ($p < 0.05$), and no significant association was found between the practice of dry sex and experience of forced sexual intercourse (of any type) within the previous 6 months. Unlike anal intercourse, no significant association was found with status as a peer education group leader, and no association was found between dry sex and ethnicity or education. There was an association, however, between the practice of anal intercourse and the practice of dry sex ($p < 0.001$). As with anal sex, there was a significant association between dry sex and reporting an STI within the previous year ($p < 0.05$), including associations between dry sex and reported genital sores ($p < 0.05$) and vaginal discharge ($p < 0.01$).

Analysis by binary logistic regression found that the practice of anal intercourse was significantly related to reported recent STI ($p < 0.05$). However, dry sex, frequency of condom use, and mean number of clients per week, although significantly related to infection in univariate analysis, were not significant as predictors when combined in a multiple regression model together with anal sex (table 4). Sex workers practising anal sex were 2.5 times more likely to report an STI than those not reporting this practice, controlling for the other variables in the equation.

DISCUSSION

The practice of anal intercourse was quite prevalent in this cohort, and was more common than found in previous studies among FSWs in the region.^{1,2} Most women surveyed

Table 3 Reported usual sexual partner, by practice

	Anal intercourse (n = 60)			Dry sex (n = 53)		
	One time clients	Regular clients	Spouse/partner	One time clients	Regular clients	Spouse/partner
Yes	78.3% (47)	43.3% (26)	5.0% (3)	79.2% (42)	60.4% (32)	13.2% (7)
No	21.7% (13)	56.7% (34)	56.7% (34)	20.8% (11)	39.6% (21)	52.8% (28)
No response	0.0% (0)	0.0% (0)	38.3% (23)	0.0% (0)	0.0% (0)	34.0% (18)
Total	100.0% (60)	100.0% (60)	100.0% (60)	100.0% (53)	100.0% (53)	100.0% (53)

Table 4 Multiple logistic regression: predictors of reported sexually transmitted infection in the past year

Variable	Odds ratio	95% CI	Significance
Practice of anal intercourse	2.518	1.198 to 5.296	0.015
Practice of dry sex	1.515	0.705 to 3.252	0.287
Frequency of condom use	1.022	0.941 to 1.110	0.612
Mean clients/week	0.970	0.905 to 1.041	0.397

believed anal intercourse to be of greater or equally high risk for STI/HIV compared with vaginal sex, but in spite of this knowledge, there was no association between perceived risk and abstinence from the practice, and condom use during anal intercourse was less consistent than during vaginal intercourse. Anal intercourse was practised most commonly with one time clients, as opposed to regular clients or committed partners. Dry sex was also common within this cohort. Most women believed dry sex to pose a greater or equally high risk for STI/HIV, compared to vaginal sex, but unlike anal intercourse, perceived risk was found to be associated with abstinence from dry sex. In comparison with anal intercourse, which was generally initiated by clients and facilitated by financial incentives, women were far more likely to initiate dry sex themselves. Nevertheless, in spite of high perceived risk, condom use during dry sex was less consistent than during standard vaginal intercourse.

Only 62% of women sampled agreed to participate, potentially resulted in sample bias. However, there is no reason to believe that women who chose not to be interviewed would be less likely to practise either of the risk behaviours; in fact, the opposite seems more likely. Of FSWs sampled, a disproportionately high percentage were peer education group leaders (15% of participants were leaders, while the peer groups are organised with only one leader per 20 other group members). As group leaders are specifically trained regarding risk factors for STI/HIV, it is possible that this may have resulted in overestimates of perceived risk and underestimates of the practice of the two sexual behaviours investigated.

Another limitation is the possibility of ecological correlation among the factors that have a particular social desirability bias, particularly the reporting of STIs and anal sex. In other words, a woman who is sufficiently confident or bold to report having had an STI may also be more likely to reveal the practice of anal sex, thus leading to a correlation between the two variables. More detailed investigative work is needed to quantify the influence of this possible bias.

The prevalence of dry sex found in this study was less than that described in similar studies of women in sub-Saharan Africa. This may be accounted for by regional variation in cultural practices and sexual preferences; dry sex has typically been described in southern and central Africa, and less commonly in east Africa.¹² In addition, we defined the practice of "dry sex" specifically as the insertion of substances into the vagina to cause drying or tightening. Many other studies have employed broader or more vague definitions, including simple wiping of vaginal secretions or ingestion of foods and other substances believed to produce a drying effect.¹²⁻¹⁴ This study's use of a strict definition restricted to methods of insertion may have underestimated the total prevalence of methods that carry the intent or result of vaginal drying.

The finding that perceived risk had no impact on abstinence from anal intercourse may be related to the financial incentives involved, with anal intercourse in particular commanding a higher price than vaginal intercourse. Female sex work in Kenya is generally undertaken as

a last resort in an environment of high unemployment, and is typically a trade of vulnerable women.²³ In such circumstances, women may have very little control over their sexual health.²⁴

Reinforcing this notion is the strong association found between the practice of anal intercourse and experience of forced sexual intercourse, an indicator of social vulnerability and a risk factor in itself for STI/HIV.²⁵ These findings suggest that the most vulnerable FSWs are the most likely to engage in anal intercourse for financial incentives. It is unlikely therefore that education alone regarding the risks of anal intercourse will be sufficient to decrease the practice or make it safer; rather, programmes empowering FSWs to negotiate for safer sex with clients, such as peer discussion and support groups, will be important.²⁶ In addition, in some instances, alternative economic activities supported by small informal "microfinance" loans and savings programmes have demonstrated the potential to decrease financial dependence on sex work.²⁷

It is difficult to alter cultural attitudes and sexual preferences,²⁸ and to counter the financial pressures imposed on sex workers to avoid risky activities in meeting clients' demands. It is important therefore to provide the means for women to exert greater control over risk factors for STI/HIV. Topical vaginal and rectal microbicides agents, which can be applied by women before intercourse without partners' knowledge or participation, have shown promise in preventing the transmission of HIV.²⁹⁻³⁰ The development and distribution of such microbicides should be vigorously pursued to allow women to reduce their risk for HIV. In particular, the findings of this study emphasise the importance of microbicides that are effective during anal and dry intercourse. In any case, education regarding high risk sexual practices needs to be translated into safer practices, particularly consistent condom use, even in the face of financial vulnerability. The design of effective HIV prevention programmes will also require a more thorough understanding of the decision making processes of sex workers in relation to these under-discussed practices.

CONTRIBUTORS

MS contributed to the study design and was the primary author of the manuscript; CM supervised and contributed to the study design, execution of the study, and preparation of the manuscript; AF contributed to the study design, execution of the study, and supervision of statistical analysis; EN contributed to the study design and preparation of the manuscript; SM contributed to the study design and supervision, and to the preparation of the manuscript.

Authors' affiliations

M Schwandt, Faculty of Medicine, University of Manitoba, Winnipeg, Canada

C Morris, Department of Medical Microbiology, University of Manitoba, Winnipeg, Canada

A Ferguson, Department of Medical Microbiology, University of Manitoba, Winnipeg, Canada

E Ngugi, Department of Community Health, University of Nairobi, Nairobi, Kenya

Key messages

- The practices of anal intercourse and dry sex were found to be more prevalent than previously reported among female sex workers in Kenya
- Although anal intercourse and dry sex were perceived by these women as high risk for sexually transmitted infections, the practices were not adequately protected with condom use
- Anal intercourse in particular was a strong predictor of reported sexually transmitted infections, as well as being associated with experience of forced sex, a marker of social vulnerability
- The findings of this study underscore the importance of improving female sex workers' control over their own sexual practices, though improved negotiation for safer sex with clients, development and use of microbicide agents, and access to alternative economic activities

S Moses, Departments of Medical Microbiology, Community Health Sciences and Medicine, University of Manitoba, Winnipeg, Canada

Sponsor details: The study was supported by grants from the Bill and Melinda Gates Foundation, the Canadian International Development Agency and Rx&D Health Research Foundation, University of Manitoba. Dr Moses is the recipient of an Investigator Award from the Canadian Institutes of Health Research.

Competing interests: none.

Ethical approval: Ethical approval granted by the University of Manitoba Health Research Ethics Board (Canada) and the Kenyatta National Hospital Ethical Review Committee (Kenya).

REFERENCES

- 1 **Ferguson A**, Morris C. Assessing the role of anal intercourse in the epidemiology of AIDS in Africa (letter). *Int J STD AIDS* 2003;**14**:856.
- 2 **Fonck K**, Kaul R, Kimani J, et al. A randomized, placebo-controlled trial of monthly azithromycin prophylaxis to prevent sexually transmitted infections and HIV-1 in Kenyan sex workers: study design and baseline findings. *Int J STD AIDS* 2000;**11**:804–11.
- 3 **Karim SS**, Ramjee G. Anal sex and HIV transmission in women. *Am J Public Health* 1998;**88**:1265–6.
- 4 **Ramjee G**, Weber AE, Morar NS. Recording sexual behavior: comparison of recall questionnaires with a coital diary. *Sex Transm Dis* 1999;**26**:374–80.
- 5 **Matasha E**, Ntembelela T, Mayaud P, et al. Sexual and reproductive health among primary and secondary school pupils in Mwanza, Tanzania: need for intervention. *AIDS Care* 1998;**10**:571–82.
- 6 **Sallah ED**, Grunitzky-Bekele M, Bassabi K, et al. Sexual behavior, knowledge and attitudes to AIDS and sexually transmitted diseases of students at the University of Benin (Togo). *Santé* 1999;**9**:101–9.
- 7 **Padian N**, Marquis L, Francis DP, et al. Male-to-female transmission of human immunodeficiency virus. *JAMA* 1987;**258**:788–90.
- 8 **Lazzarin A**, Saracco A, Musicco M, et al. Man-to-woman transmission of the human immunodeficiency virus. Risk factors related to sexual behavior, man's infectiousness, and women's susceptibility. *Arch Intern Med* 1991;**151**:2411–16.
- 9 **Royce RA**, Sena A, Cates W, et al. Sexual transmission of HIV. *N Engl J Med* 1997;**336**:1072–8.
- 10 **Van Damme L**, Ramjee G, Alary M, et al. Effectiveness of COL-1492, a nonoxynol-9 vaginal gel, on HIV-1 transmission in female sex workers: a randomized controlled trial. *Lancet* 2002;**360**:971–7.
- 11 **Karim QA**. Anal sex and HIV transmission in adolescent women in rural South Africa. Centre for the AIDS Programme of Research in South Africa. *Newsletter* 2003;**2**:2–3.
- 12 **Brown JE**, Brown RC. Traditional intravaginal practices and the heterosexual transmission of disease. *Sex Transm Dis* 2000;**27**:183–7.
- 13 **Rungara A**, Pitts M, McMaster J. The use of herbal and other agents to enhance sexual experience. *Soc Sci Med* 1992;**35**:1037–42.
- 14 **Brown JE**, Ayowa OB, Brown RC. Dry and tight: sexual practices and potential AIDS risk in Zaire. *Soc Sci Med* 1993;**37**:989–94.
- 15 **Nyirenda MJ**. A study of the behavioural aspects of dry sex practice in urban Lusaka. Eighth International Conference on AIDS, 1992;**8**:D461.
- 16 **Kilmarx PH**, Limpakarnjanarat K, Supawitkul S, et al. Mucosal disruption due to use of a widely distributed commercial vaginal product: potential to facilitate HIV transmission. *AIDS* 1998;**12**:767–73.
- 17 **Kreiss JK**, Coombs R, Plummer F, et al. Isolation of human immunodeficiency virus from genital ulcers in Nairobi prostitutes. *J Infect Dis* 1989;**160**:380–4.
- 18 **Beksinska ME**, Rees HV, Kleinschmidt I, et al. The practice and prevalence of dry sex among men and women in South Africa: a risk factor for sexually transmitted infections? *Sex Transm Infect* 1999;**75**:178–80.
- 19 **Hira SK**, Mangrola UG, Mwale C, et al. Apparent vertical transmission of human immunodeficiency virus type 1 by breast-feeding in Zambia. *J Pediatr* 1990;**117**:421–4.
- 20 **Sandala L**, Lurie P, Sunkutu MR, et al. 'Dry sex' and HIV infection among women attending a sexually transmitted diseases clinic in Lusaka, Zambia. *AIDS* 1995;**9**(Suppl 1):S61–8.
- 21 **Civic D**, Wilson D. Dry sex in Zimbabwe and implications for condom use. *Soc Sci Med* 1996;**42**:91–8.
- 22 **Cleland J**, Boerma JT, Carael M, et al. Monitoring sexual behaviour in general populations: a synthesis of lessons of the past decade. *Sex Transm Infect* 2004;**80**(S2):S1–7.
- 23 **Plummer FA**, Nagelkerke NJ, Moses S, et al. The importance of core groups in the epidemiology and control of HIV-1 infection. *AIDS* 1991;**5**(S1):S169–76.
- 24 **Gupta GR**, Weiss E, Whelan D. Male-female inequalities result in submission to high-risk sex in many societies. *AIDS Anal Afr* 1995;**5**:8–9.
- 25 **Maman S**, Campbell J, Sweat MD, et al. The intersections of HIV and violence: directions for future research and interventions. *Soc Sci Med* 2000;**50**:459–78.
- 26 **Moses S**, Ngugi EN, Costigan A, et al. Response of a sexually transmitted infection epidemic to a treatment and prevention programme in Nairobi, Kenya. *Sex Transm Infect* 2002;**78**(Suppl 1):i14–20.
- 27 **Parker J**, Singh I, Hattel K. *The role of microfinance in the fight against HIV/AIDS: report to the Joint United Nations Programme on HIV/AIDS*. Washington, DC: Development Alternatives Inc, 2000.
- 28 **Gausset Q**. AIDS and cultural practices in Africa: the case of the Tonga (Zambia). *Soc Sci Med* 2001;**52**:509–18.
- 29 **Stone A**. Microbicides: a new approach to preventing HIV and other sexually transmitted infections. *Nat Rev Drug Discov* 2002;**1**:977–85.
- 30 **Shattock RA**, Moore JP. Inhibiting sexual transmission of HIV-1 infection. *Nat Rev Microbiol* 2003;**1**:25–34.